PHOENIX CONTACT
SOUTHEAST ASIA

Designing Reliable and Future-Ready Data Centers

Mr Chayangkul Sumitpaibul

Business Development Engineer

Phoenix Contact Southeast Asia

IIEE Seminar

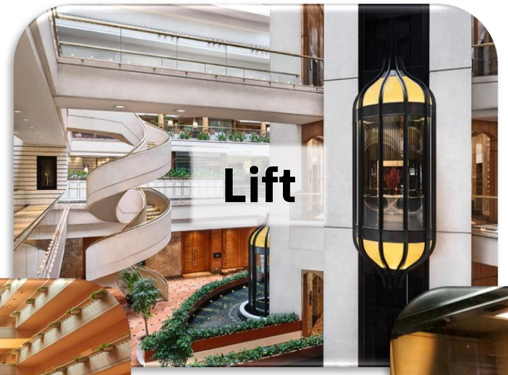
Agenda

1. Introduction of Data Center
2. Overview of Systems in Data Center
3. Design for Availability and Sustainability
4. Future Challenges & Strategies

IIEE Seminar

Quiz 1

How much power do you think Conrad Orchard Hotel uses at peak demand?



< 1 MW

≈ 5 MW

> 10 MW

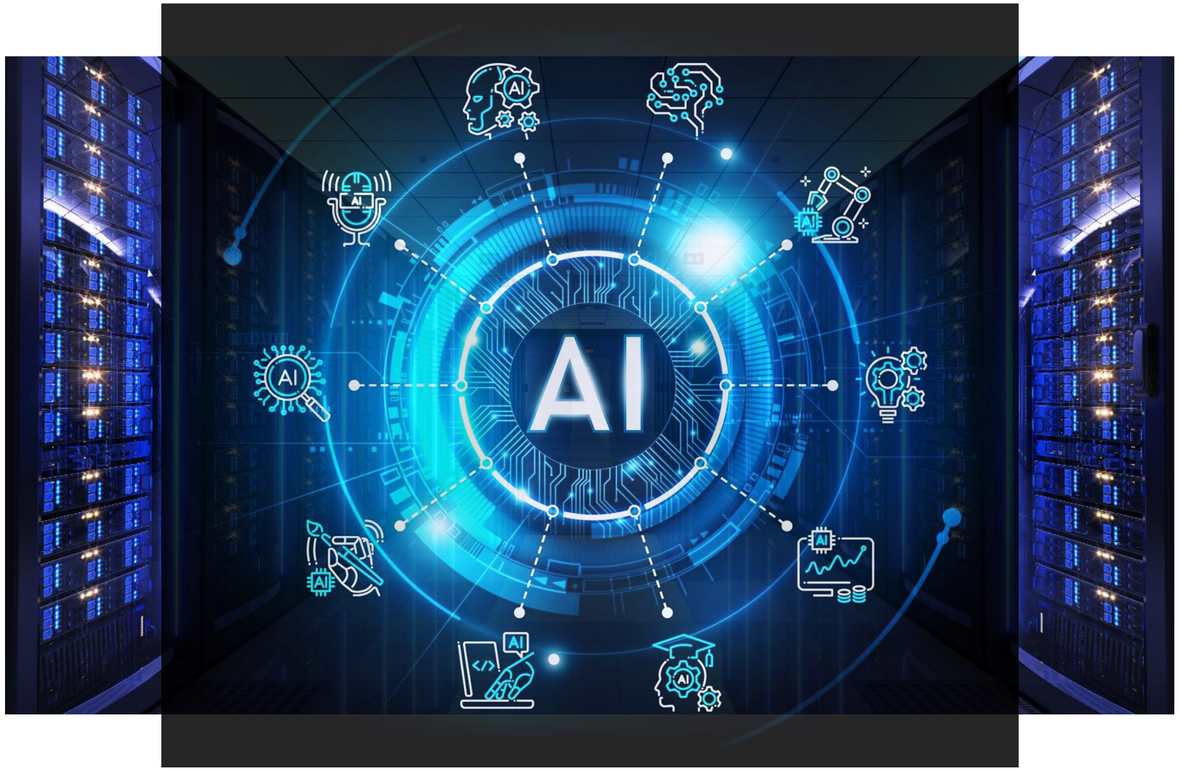
IIEE Seminar

Introduction of Data Center

- What is a data center?

IIEE Seminar

What is Data Center?



Data Storage

Cloud Computing

Backup Recovery

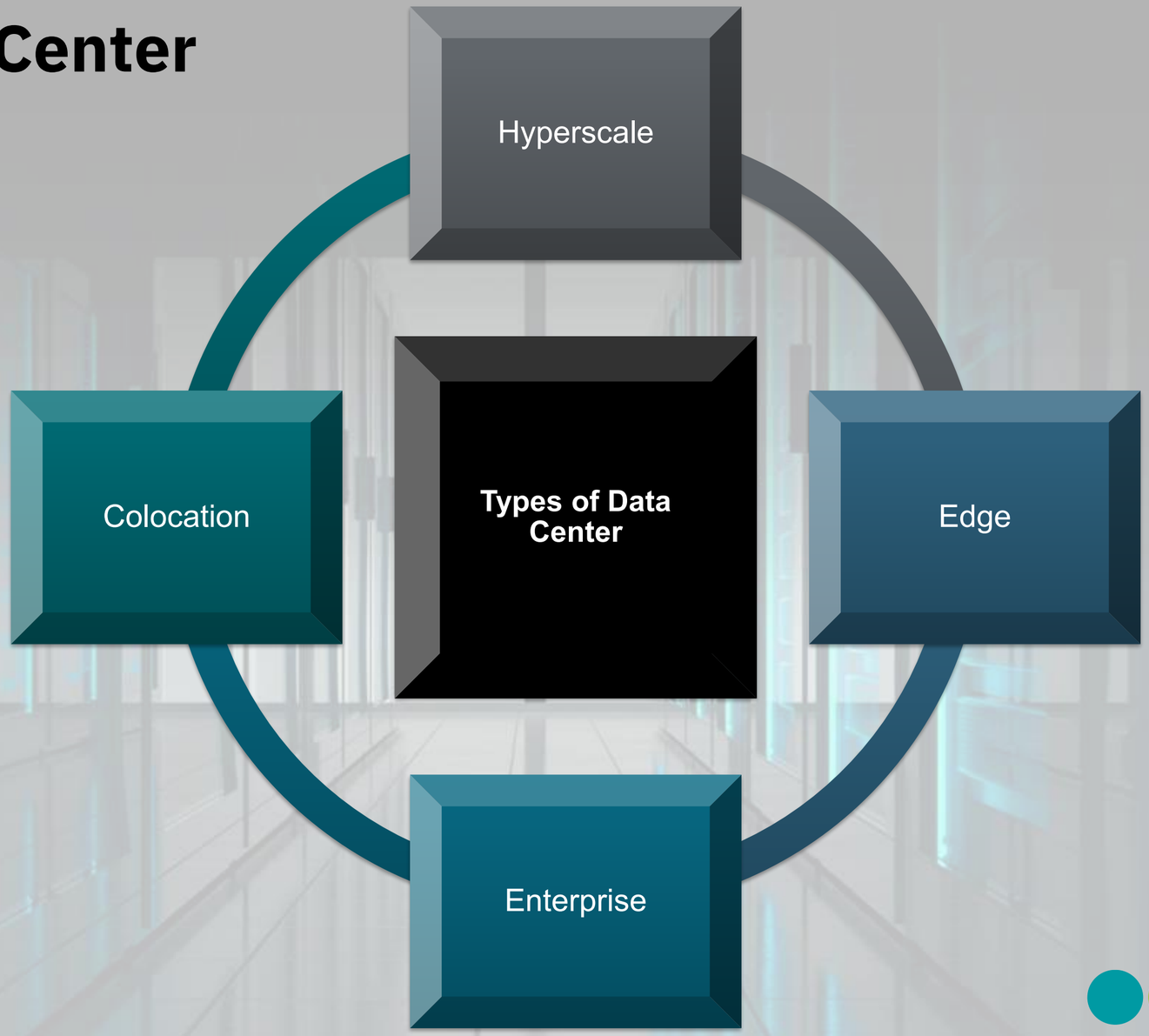
Web Hosting

Company's IT

Data Center is a physical facility that houses and manages a large collection of computing and networking equipment to **store**, **process**, and **distribute data** for businesses and organizations.

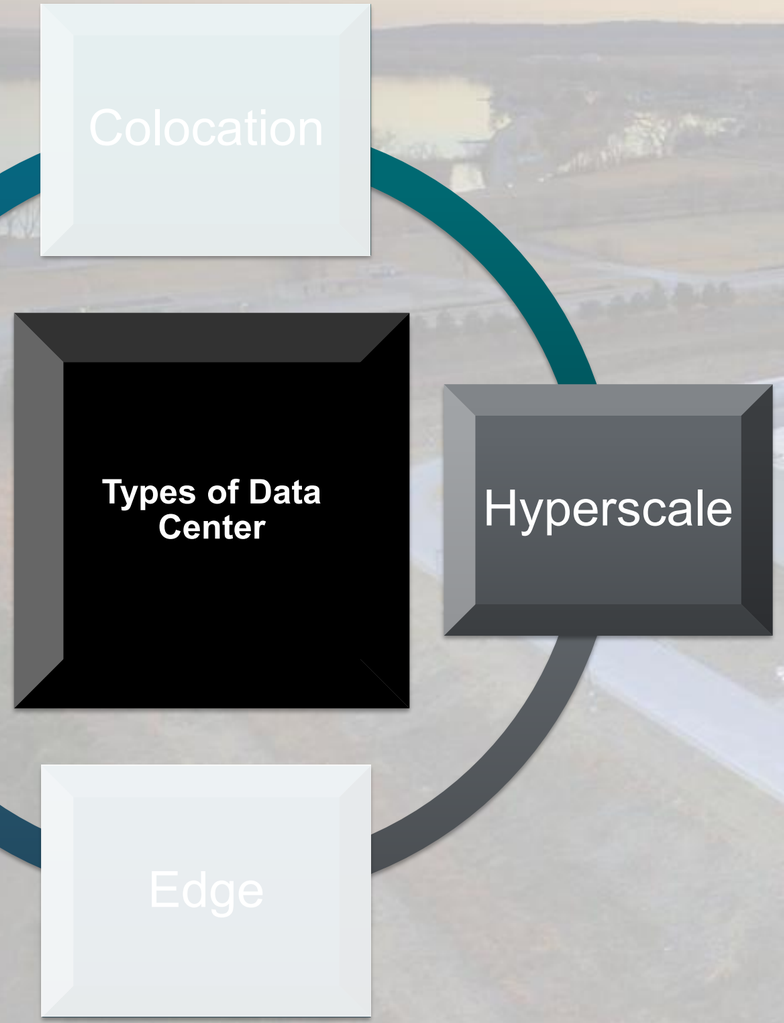
IIEE Seminar

Types of Data Center



IIEE Seminar

Hyperscale Data Center



Massive facilities owned and operated by **big tech companies** designed to scale quickly and support **cloud computing, big data, and AI workloads**.

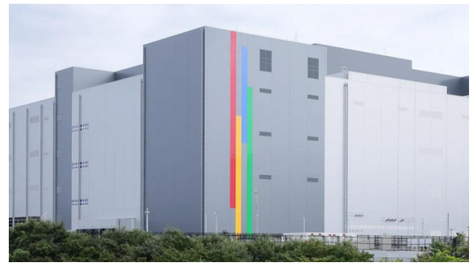
Power Capacity	Server Racks	Land Area
50 MW to > 150+ MW	5,000 to 50,000+	100,000+ ft²

aws Microsoft Azure Google Cloud Meta

Hyperscale Data Center Examples

Amazon Data Center (Oregon, USA)

Meta Data Center
(Singapore)

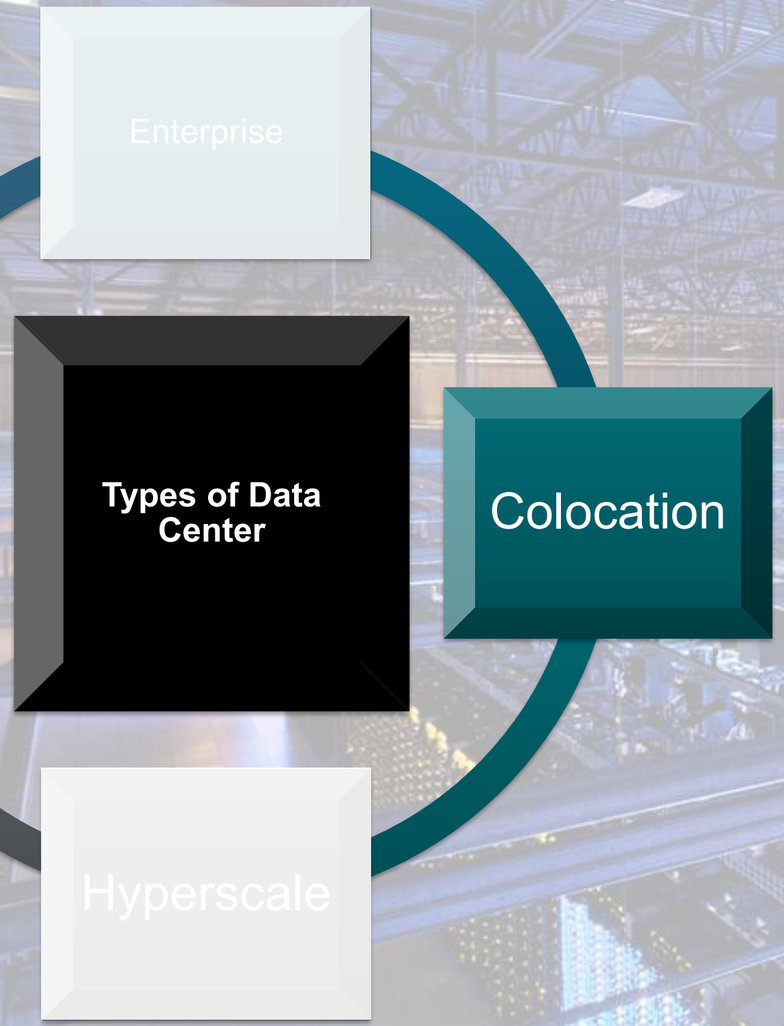


Google Data Center
(Inzai, Japan)

Microsoft Data Center
(Busan, South Korea)

IIEE Seminar

Colocation Data Center



Facilities where businesses **rent out space**, **offer power, cooling, physical security,** and **connectivity** to the customer while the **customer retains control over their servers** and **hardware**.

Power Capacity	Server Racks	Land Area
1 MW to 50 MW	Hundreds to Thousands	10,000 to 100,000+ ft²

EQUINIX

DIGITAL REALTY

NTT DATA

Keppel Data Centres

ST Telemedia Global Data Centres

PHOENIX CONTACT

Colocation Data Center Examples

STTelemedia Global Data Centres

STTelemedia Global, Singapore

STACK INFRASTRUCTURE

STACK Infrastructure
(Malaysia)

DIGITAL REALTY

Digital Realty
(Busan, South Korea)

EQUINIX

Equinix
(Tokyo, Japan)

NTT DATA

NTT Data
(Bangkok, Thailand)

DCI INDONESIA

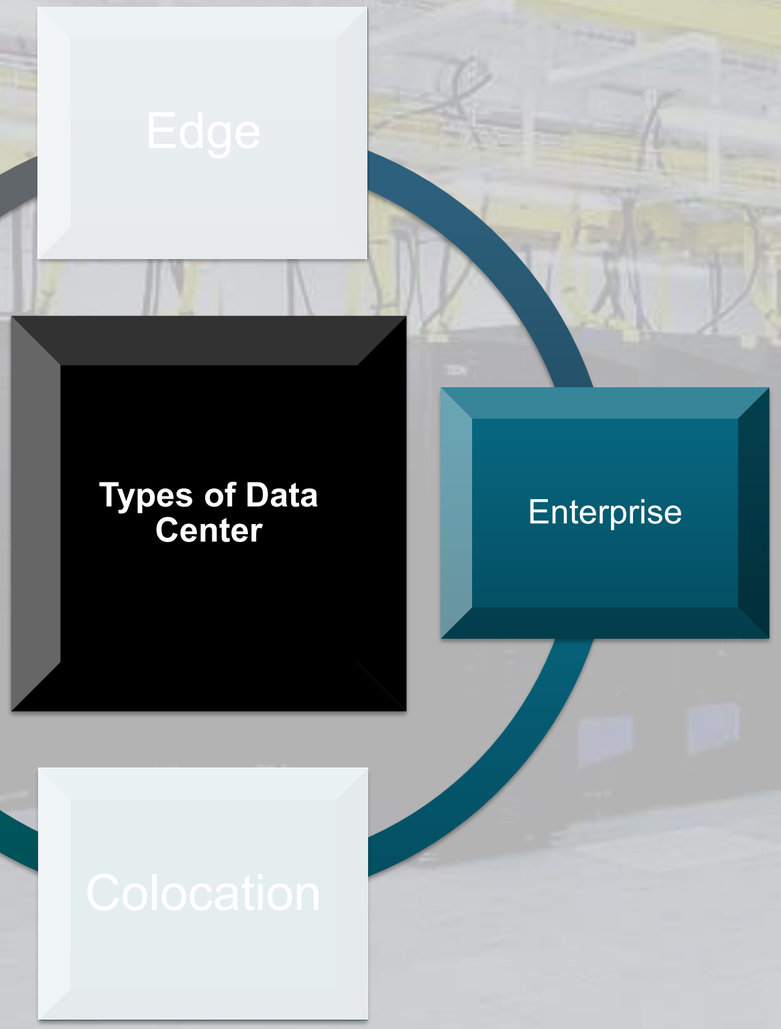
DCI
(Karawang, Indonesia)

TELEHOUSE

TELEHOUSE
(Hanoi, Vietnam)

IIEE Seminar

Enterprise Data Center

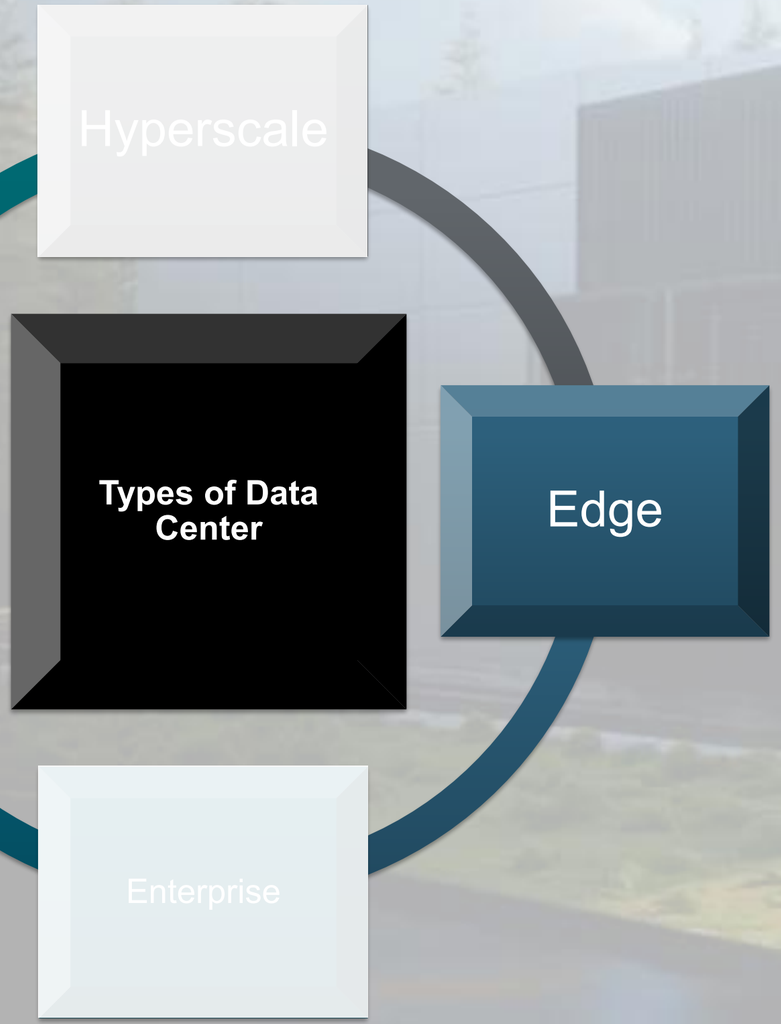


An enterprise data center is a **private**, **on-premises** or **off-premises** facility **owned and operated by a single organization** to meet its specific IT needs.

Power Capacity	Server Racks	Land Area
500 kW to 5 MW	Tens to Hundreds	2,000 to 20,000+ ft²

IIEE Seminar

Edge Data Center



An edge data center is a **smaller**, **decentralized** computing facility, strategically **located closer to end-users** and the servers **process data locally, has lower latency** as compared to a traditional data center.

Power Capacity	Server Racks	Land Area
< 500 kW	< 50 Servers	< 2,000 ft²

Hewlett Packard Enterprise

VERTIV

ORACLE

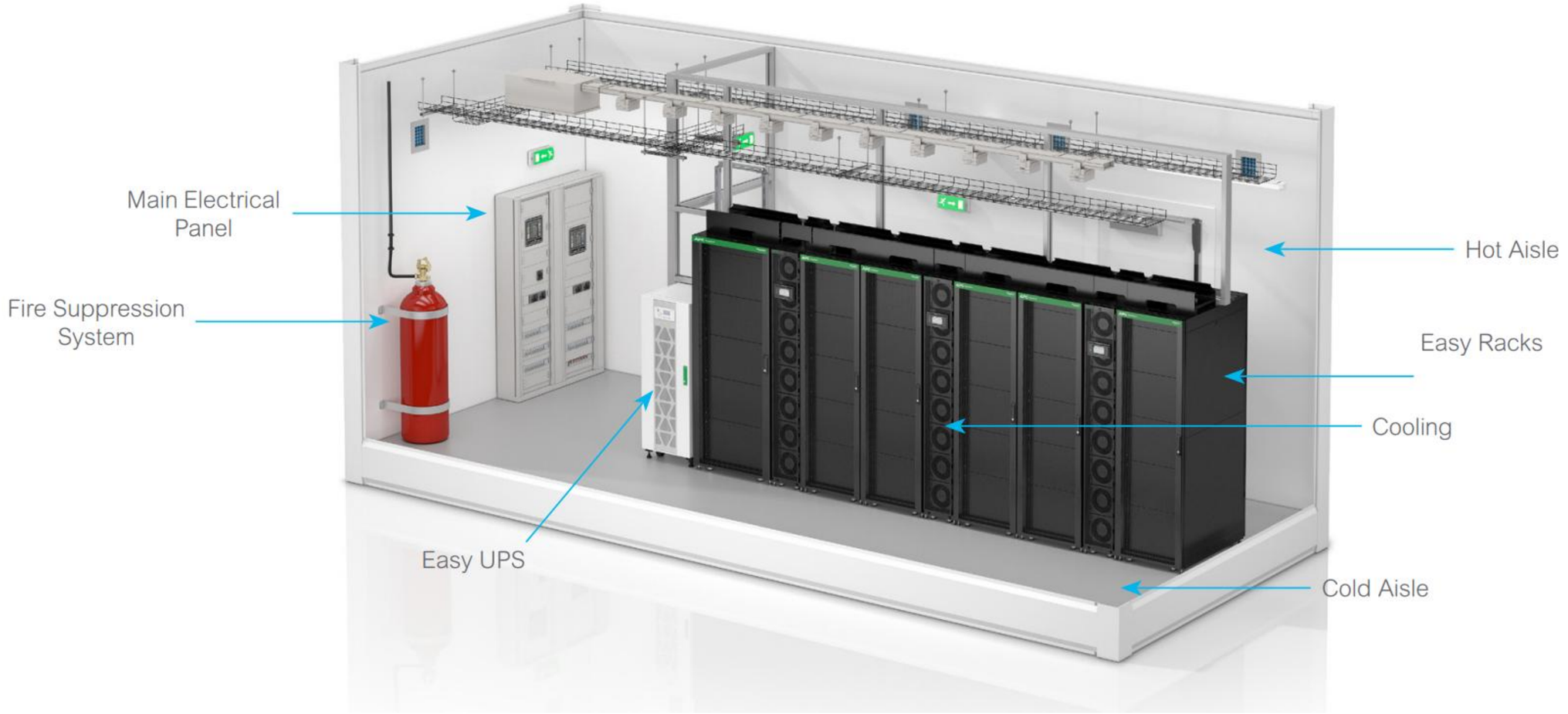
IBM

DELL

PHOENIX CONTACT

IIEE Seminar

Additional: Containerized and Modular Data Centers



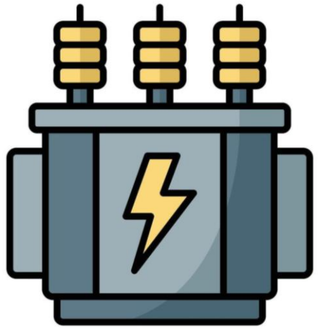
Overview of Systems in Data Center

IIEE Seminar

Data Center Subsystems

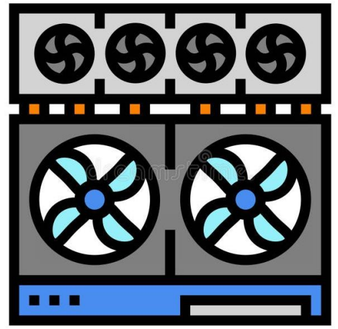
Power Infrastructure

- Low / Medium Voltage Switchgear
- Uninterruptible Power Supplies (UPS)
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution in Data Hall



Cooling Infrastructure

- HVAC - AHU, Chillers
- Computer Room (CRAC/CRAH)
- Hot/Cold Aisle Containment
- Raised Floor Systems
- Liquid Cooling (Direct chip, Immersion)



Data Center Management

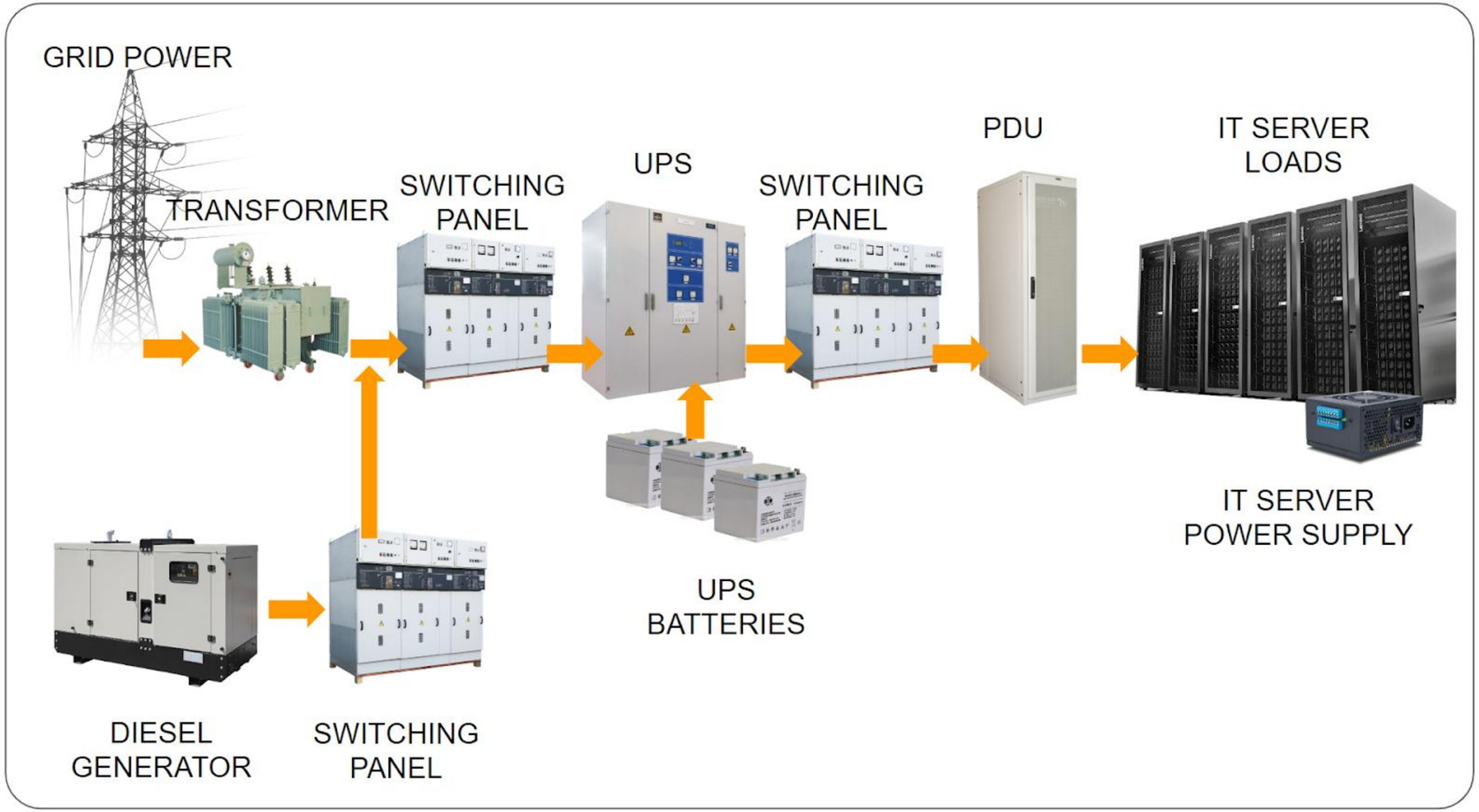
- Building Management System (BMS)
- Data Center Infrastructure Management (DCIM)
- Electrical Power Monitoring System (EPMS)
- Environmental Monitoring System (EMS)

IIEE Seminar

Data Center Subsystems – Power Infrastructure Overview

Power Infrastructure

- Low / Medium Voltage Switchgear
- Uninterruptible Power Supplies (UPS)
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution in Data Hall



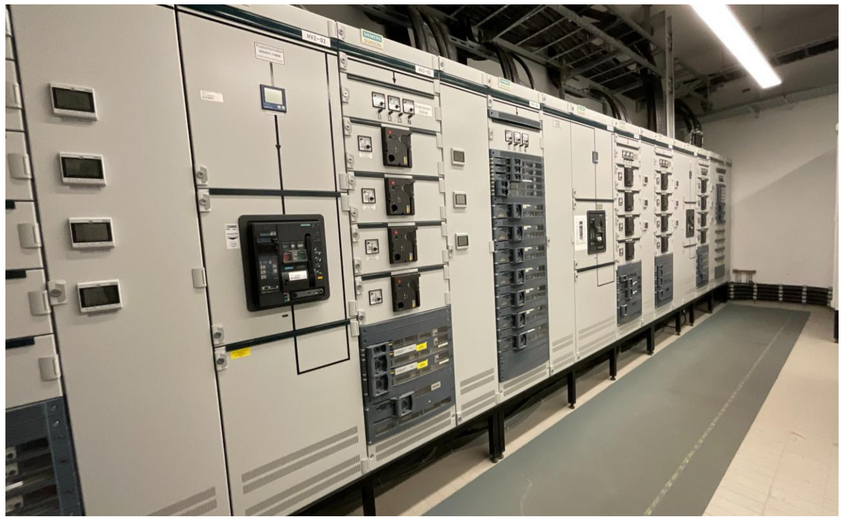
IIEE Seminar

Data Center Subsystem – Switchgear

Power Infrastructure

- **Low / Medium Voltage Switchgear**
- Uninterruptible Power Supplies (UPS)
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution in Data Hall

- Low / Medium Voltage Switchgear
  - **Central distribution point** for electrical power ensuring reliable and safe delivery to critical IT equipment
  - E.g. 22kV → 11kV → 415/230VAC



Data Center Subsystem – Uninterruptible Power Supplies (UPS)

Power Infrastructure

- Low / Medium Voltage Switchgear
- **Uninterruptible Power Supplies (UPS)**
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution in Data Hall

- Uninterruptible Power Supplies (UPS) – Batteries
  - Provide **immediate**, **short-term power** in case utility outage
  - Protection against **power outages** and **fluctuations**
  - **Give time for generators to start** or for systems to shutdown

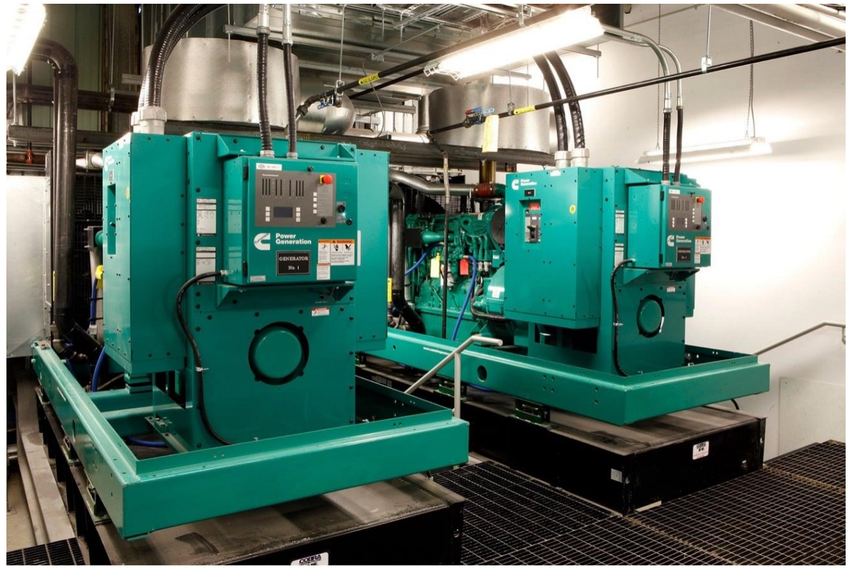
IIEE Seminar

Data Center Subsystem – Generators

Power Infrastructure

- Low / Medium Voltage Switchgear
- Uninterruptible Power Supplies (UPS)
- **Generators - Backup Power**
- Transfer Switches (ATS/STS)
- Power Distribution in Data Hall

- Generators – Backup Power
  - Provide **long-term backup power** in case of extended utility outage
  - Run by diesel (common) or natural gas (lower emission)



IIEE Seminar

Data Center Subsystem – Transfer Switches (ATS/STS)

Power Infrastructure

Low / Medium Voltage Switchgear

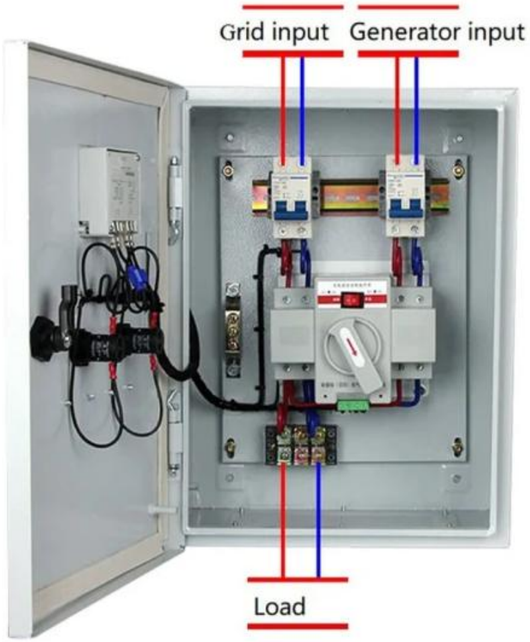
Uninterruptible Power Supplies (UPS)

Generators - Backup Power

Transfer Switches (ATS/STS)

Power Distribution in Data Hall

- Transfer Switches
  - Automatic Transfer Switch (ATS) / Static Transfer Siwtches (STS)
- Automatically **switches power supply** from **primary source (utility)** to **secondary source (generator)** to ensure **seamless power delivery**



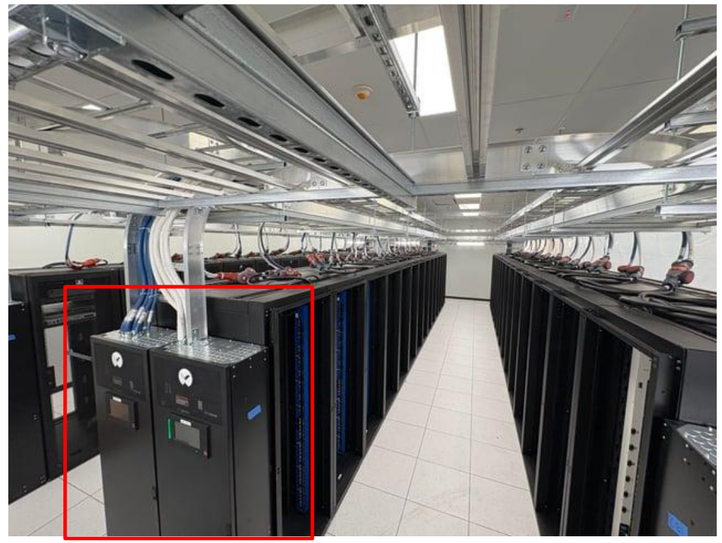
Data Center Subsystem – Power Distribution in Data Hall

Power Infrastructure

- **Low / Medium Voltage Switchgear**
- **Uninterruptible Power Supplies (UPS)**
- **Generators - Backup Power**
- **Transfer Switches (ATS/STS)**
- **Power Distribution in Data Hall**

- Power Distribution Unit (PDU) & Remote Power Panel
  - **Distribute power** from **UPS** and **generators** to individual **server racks** and IT equipment

Power Distribution Unit



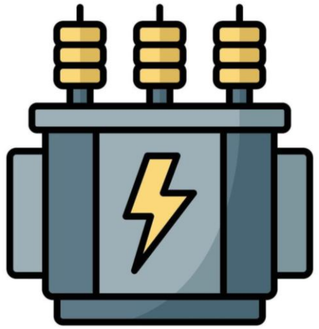
Remote Power Panel

IIEE Seminar

Data Center Subsystems

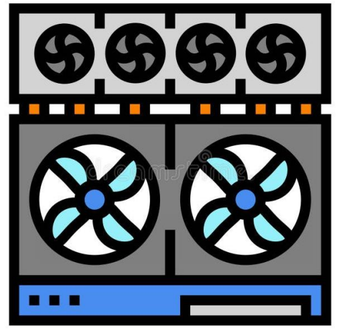
Power Infrastructure

- Low / Medium Voltage Switchgear
- Uninterruptible Power Supplies (UPS)
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution Unit (PDU)



Cooling Infrastructure

- HVAC - AHU, Chillers
- Computer Room (CRAC/CRAH)
- Hot/Cold Aisle Containment
- Raised Floor Systems
- Liquid Cooling (Direct chip, Immersion)



Data Center Management

- Building Management System (BMS)
- Data Center Infrastructure Management (DCIM)
- Electrical Power Monitoring System (EPMS)
- Environmental Monitoring System (EMS)

Data Center Subsystem – Cooling Infrastructure Overview

Cooling Infrastructure

HVAC - AHU, Chillers

Computer Room (CRAC/CRAH)

Hot/Cold Aisle Containment

Raised Floor Systems

Liquid Cooling (Direct chip, Immersion)

- Purpose – To **dissipate significant heat** generated by IT equipment to **prevent overheating** and **ensure optimal performance**.

Data Center Subsystem – HVAC (AHU, Chillers)

Cooling Infrastructure

HVAC – AHU, Chillers

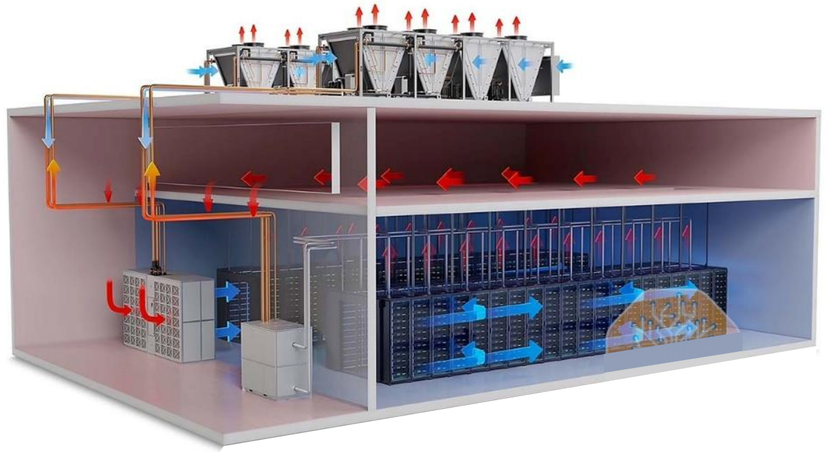
Computer Room (CRAC/CRAH)

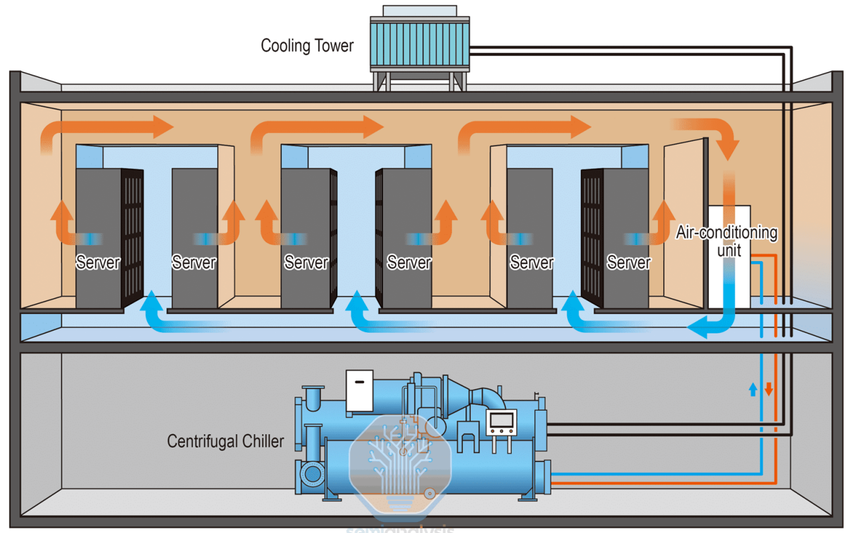
Hot/Cold Aisle Containment

Raised Floor Systems

Liquid Cooling (Direct chip, Immersion)

- Heating, Ventilation, and Air Conditioning (HVAC)
  - Air Handling Unit (AHU), Chillers, Ventilation Fan, Cooling Tower
- Controls **overall ambient environment** including
  - Temperature, humidity, airflow, air filtration



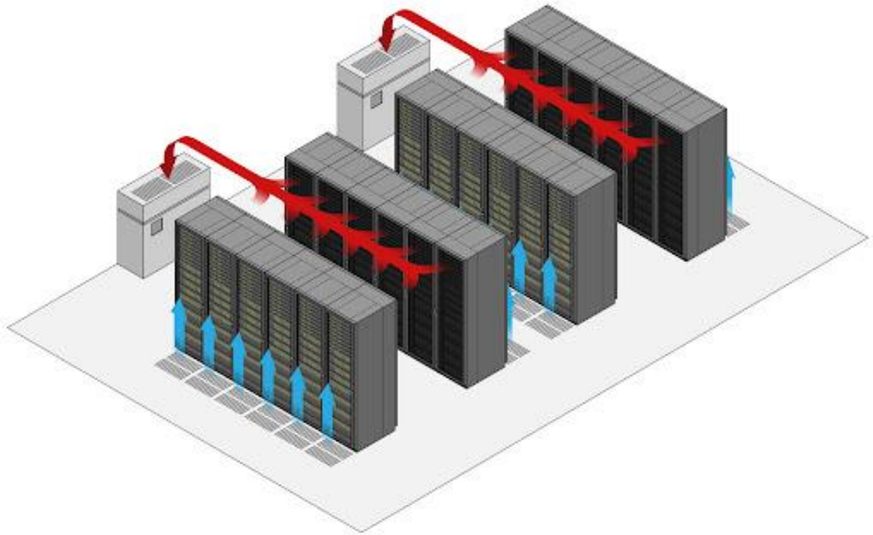


Data Center Subsystem – Computer Room (CRAC/CRAH)

Cooling Infrastructure

- HVAC - AHU, Chillers
- **Computer Room (CRAC/CRAH)**
- Hot/Cold Aisle Containment
- Raised Floor Systems
- Liquid Cooling (Direct chip, Immersion)

- Computer Room Air Conditioning (CRAC) – Uses refigerant and compressor
  - Preferred for **smaller data centers** with **lower power requirements**
  - **High reliability**, **directly controlling temperature** and **humidity** of data hall
- Computer Room Air Handlers (CRAH) – Uses chilled water and control valves
  - Favored for **larger facilities** with **higher power densities** (Hyperscale data center)
  - Offer **more precise temperature control** and **greater energy efficiency**, scalable



Data Center Subsystem – Hot/Cold Aisle Containment

Cooling Infrastructure

HVAC - AHU, Chillers

Computer Room (CRAC/CRAH)

Hot/Cold Aisle Containment

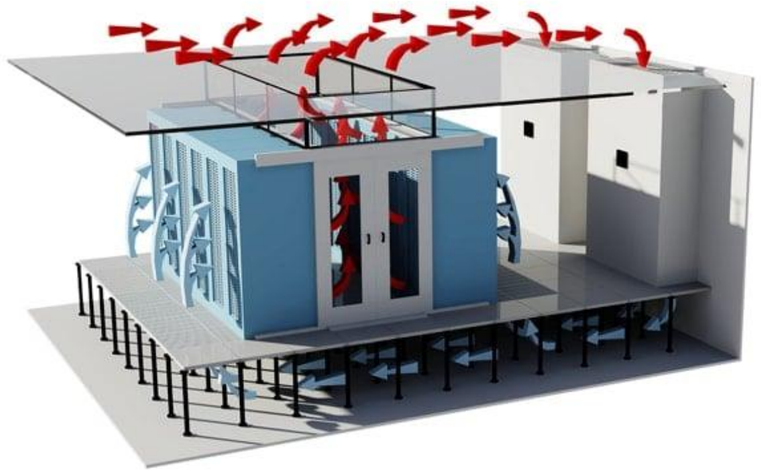
Raised Floor Systems

Liquid Cooling (Direct chip, Immersion)

- Hot/Cold Aisle Containment
  - **Physical barriers** to separate hot exhaust air from cold intake air of servers, **improving cooling efficiency**.
- Hot Aisle Containment (HAC) vs Cold Aisle Containment (CAC)

→ Lower energy consumption for cooling

→ Consistent and targeted cooling supply to server

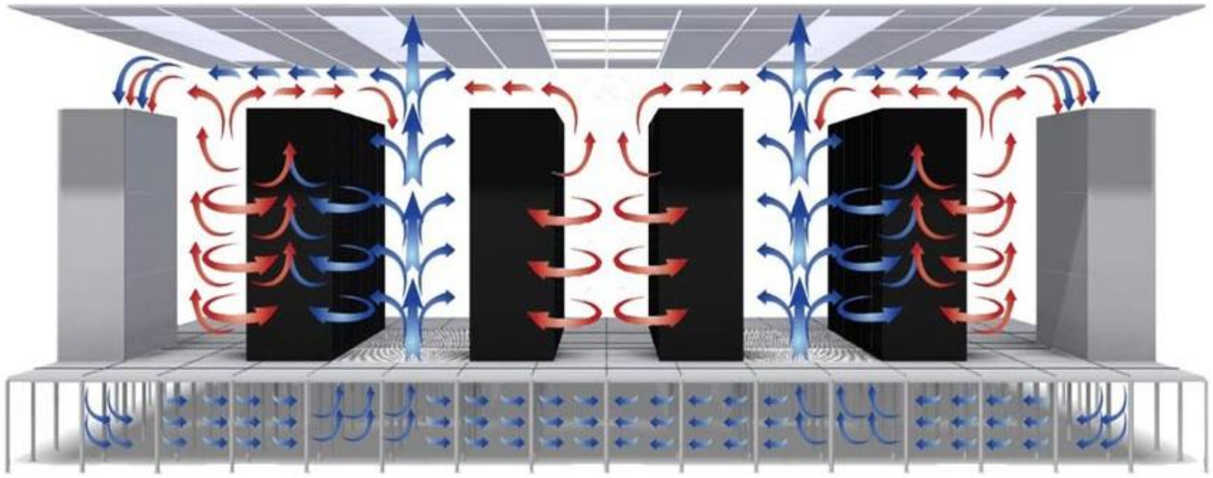


Data Center Subsystem – Raised Floor Systems

Cooling Infrastructure

- HVAC - AHU, Chillers
- Computer Room (CRAC/CRAH)
- Hot/Cold Aisle Containment
- **Raised Floor Systems**
- Liquid Cooling (Direct chip, Immersion)

- Raised Floor
  - Space beneath the raised floor acts as a plenum for air distribution
  - Cable management – hidden power/data cable, more organised, improve safety

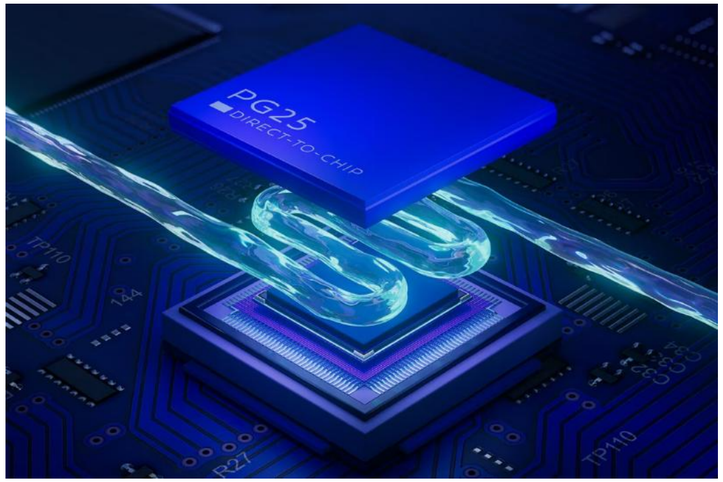


Data Center Subsystem – Liquid Cooling (Direct chip, Immersion)

Cooling Infrastructure

- HVAC - AHU, Chillers
- Computer Room (CRAC/CRAH)
- Hot/Cold Aisle Containment
- Raised Floor Systems
- **Liquid Cooling (Direct chip, Immersion)**

- Liquid Cooling (Direct chip, Immersion Cooling)
  - Most advanced methods that use liquid **directly in contact** with or near components for **highly efficient heat removal**, especially for high-density compute power such as GPUs.

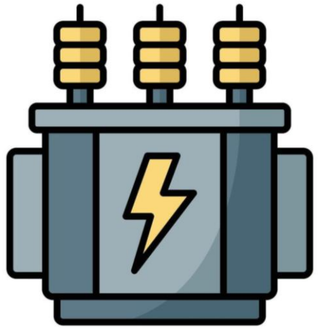


IIEE Seminar

Data Center Subsystems

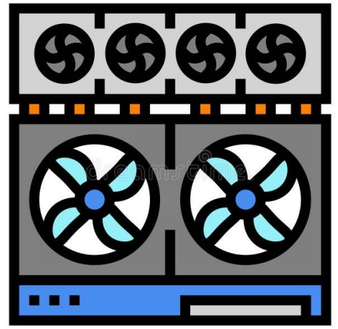
Power Infrastructure

- Low / Medium Voltage Switchgear
- Uninterruptible Power Supplies (UPS)
- Generators - Backup Power
- Transfer Switches (ATS/STS)
- Power Distribution Unit (PDU)



Cooling Infrastructure

- HVAC - AHU, Chillers
- Computer Room (CRAC/CRAH)
- Hot/Cold Aisle Containment
- Raised Floor Systems
- Liquid Cooling (Direct chip, Immersion)



Data Center Management

- Building Management System (BMS)
- Data Center Infrastructure Management (DCIM)
- Electrical Power Monitoring System (EPMS)
- Environmental Monitoring System (EMS)

Data Center Subsystem – Data Center Management Overview

Data Center Management

- **Building Management System (BMS)**
- **Data Center Infrastructure Management (DCIM)**
- **Electrical Power Monitoring System (EPMS)**
- **Environmental Monitoring System (EMS)**

- Ensure **reliable**, **secured**, and **efficient** operation of data center
- Oversees the data center **infrastructure**, including **hardware**, **software**, and **networks**.

IIEE Seminar

Data Center Subsystem – Building Management System

Data Center Management

- **Building Management System (BMS)**
- Data Center Infrastructure Management (DCIM)
- Electrical Power Monitoring System (EPMS)
- Environmental Monitoring System (EMS)

- Building Management System (BMS)
  - Centralized computer-based control system that **monitors**, **manages**, and **controls** a **building's essential systems** like HVAC, lighting, fire safety, and access control.

powered by niagara framework®

Data Center Subsystem – Data Center Infrastructure Management

Data Center Management

- Building Management System (BMS)
- **Data Center Infrastructure Management (DCIM)**
- Electrical Power Monitoring System (EPMS)
- Environmental Monitoring System (EMS)

- Data Center Infrastructure Management (DCIM)
  - **Software solutions** that **monitors health** and **performance** of **servers, racks, and power usage**.
    - Feeding data back to optimize capacity and prevent downtime
  - Tools used to **monitor, measure, manage** and control data center utilization and energy consumption of all **IT-related equipment.**

Data Center Subsystem – Electrical Power Monitoring System

Data Center Management

- Building Management System (BMS)
- Data Center Infrastructure Management (DCIM)
- **Electrical Power Monitoring System (EPMS)**
- Environmental Monitoring System (EMS)

- Electrical Power Monitoring System (EPMS)
  - System that **monitors and manages** a data center's **electrical infrastructure**, providing **real-time insights** into **power consumption** and the **health of electrical network**.

IIEE Seminar

Data Center Subsystem – Environmental Monitoring System

Data Center Management

- **Building Management System (BMS)**
- **Data Center Infrastructure Management (DCIM)**
- **Electrical Power Monitoring System (EPMS)**
- **Environmental Monitoring System (EMS)**

- Environmental Monitoring System (EMS)
  - System that continuously monitors the **environmental conditions** within the facility to ensure **optimal operating conditions** for IT equipment and prevent potential issues.
- Sensors → Track Metrics (Temperature, humidity, airflow, etc…)

What are the considerations for designing data center?

Consideration 1: Adapt to Redundant Design

Data Center's operations emphasize high availability:

- By implementing redundant systems that focus on **power** and **cooling** applications.

  I. Power: Utility sources, Generators, AC UPS, Switchgears, PDU, Sever Racks Power Supplies

  II. Cooling: Chillers, CRAC/CRAH, Coolant Distribution Units (CDU)

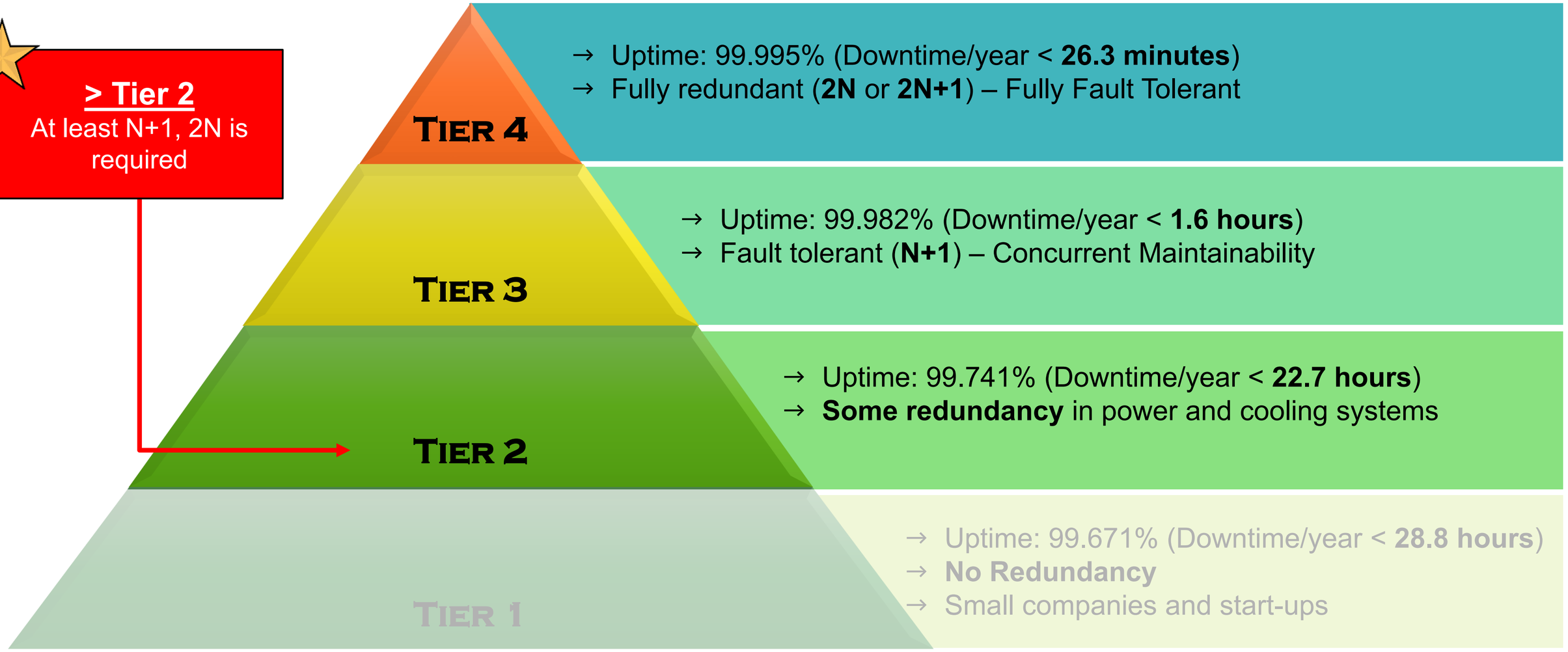
- Can be achieved by incorporating **backup** or **duplicate** systems in hot/cold standby to take over if a system fails.

*Common challenges would be **maintaining uptime during upgrades/modifications.**

IIEE Seminar

Uptime Institute

> Tier 2
At least N+1, 2N is required


Tier 4
→ Uptime: 99.995% (Downtime/year < **26.3 minutes**)
→ Fully redundant (**2N** or **2N+1**) – Fully Fault Tolerant
Tier 3
→ Uptime: 99.982% (Downtime/year < **1.6 hours**)
→ Fault tolerant (**N+1**) – Concurrent Maintainability
Tier 2
→ Uptime: 99.741% (Downtime/year < **22.7 hours**)
→ **Some redundancy** in power and cooling systems
Tier 1
→ Uptime: 99.671% (Downtime/year < **28.8 hours**)
→ **No Redundancy**
→ Small companies and start-ups

Redundancy Definition under TIA-942

> Rated 2
Redundancy path/components

Rated 4
- → Fault Tolerant Site Infrastructure
- → **Redundancy paths & components**
  - → Maintainable
  - → Fault Tolerant

Rated 3
- → Concurrent Maintainable Site Infrastructure
- → **Redundancy paths & components**
  - → Maintainable

Rated 2
- → Redundant Components Site Infrastructure
- → Single path, **some redundancy components**

Rated 1
- → Basic Site Infrastructure
- → Single path, **NO redundancy components**

Example of Certified Data Centers in Singapore

Project	Awards
1-Net North Data Center	Tier III Certification of Design Documents
Singapore 1 Data Centre, Levels 4-6	Tier III Certification of Design Documents
Dodid Data Center SG1, Level 2 Phase 1 and Levels 3 and 4	Tier III Certification of Design Documents
Equinix SG4 DH3-1	Tier III Certification of Design Documents Tier III Certification of Constructed Facility
IO Datacenter Singapore	Tier III Certification of Design Documents
Keppel DC Singapore 4 Pte Ltd	Tier III Certification of Design Documents
Level 5 Data Centre	Tier III Certification of Design Documents
Kingsland DC Data Hall 3-4	Tier III Certification of Design Documents
SGX Co-Location Data Center	Tier III Certification of Design Documents
STT DEFU	Tier III Certification of Design Documents

Uptime Institute

KEPPEL DATA CENTRES HOLDING PTE LTD, KEPPEL DCS3 SERVICES PTE LTD

Address: 27 Tampines Street 92, Singapore -
Located in Singapore, South East Asia

CERTIFICATION	RATING	STATUS	INITIAL CERT	ISSUE DATE	EXPIRY DATE
ANSI/TIA-942-B Constructed Facility	3	Active	04/19/2018	04/28/2025	04/27/2028

SINGAPORE TELECOMMUNICATIONS LTD, PASIR RIS TELECOMMUNICATIONS FACILITY

Address: Levels 2, 3, 4 & 5 Computer Rooms, 5 Pasir Ris Street 51, -
Located in Singapore, South East Asia

CERTIFICATION	RATING	STATUS	INITIAL CERT	ISSUE DATE	EXPIRY DATE

NCS PTE. LTD., DC19 DATA CENTRE

Address: 7 Bedok South Road, Singapore -
Located in Singapore, South East Asia

CERTIFICATION	RATING	STATUS	INITIAL CERT	ISSUE DATE	EXPIRY DATE
ANSI/TIA-942-B Constructed Facility	3	Withdrawn	01/19/2024	01/19/2024	01/18/2027

BDX (SINGAPORE) PTE LTD

Address: 110 Paya Lebar Road, Singapore -
Located in Singapore, South East Asia

CERTIFICATION	RATING	STATUS	INITIAL CERT	ISSUE DATE	EXPIRY DATE
ANSI/TIA-942-B Constructed Facility	3	Active	03/30/2023	03/30/2023	03/29/2026

TIA-942

Redundancy Terms

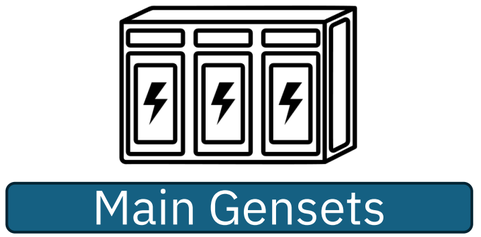
2N?

N+1?

2N+1?

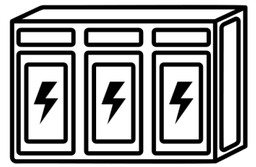
Redundancy Terms in Power System Context

- Power System need to be able to adapt to either **N+1, 2N or 2N+1 requirements**, this ensure the **extra unit** or a **secondary power systems** to take over during **main power failure** to ensure maximum reliability.

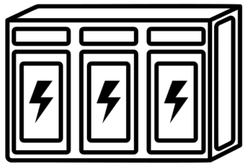


+

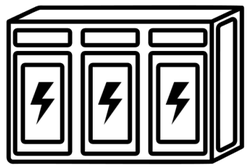
- N+1: If any **genset** fails, the **extra** unit takes over.



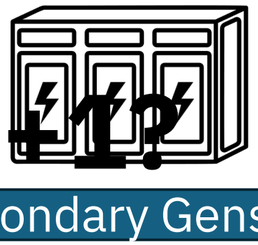
+



- 2N: If the **primary** set fails, the **secondary** set take over.



+ 2N+1?

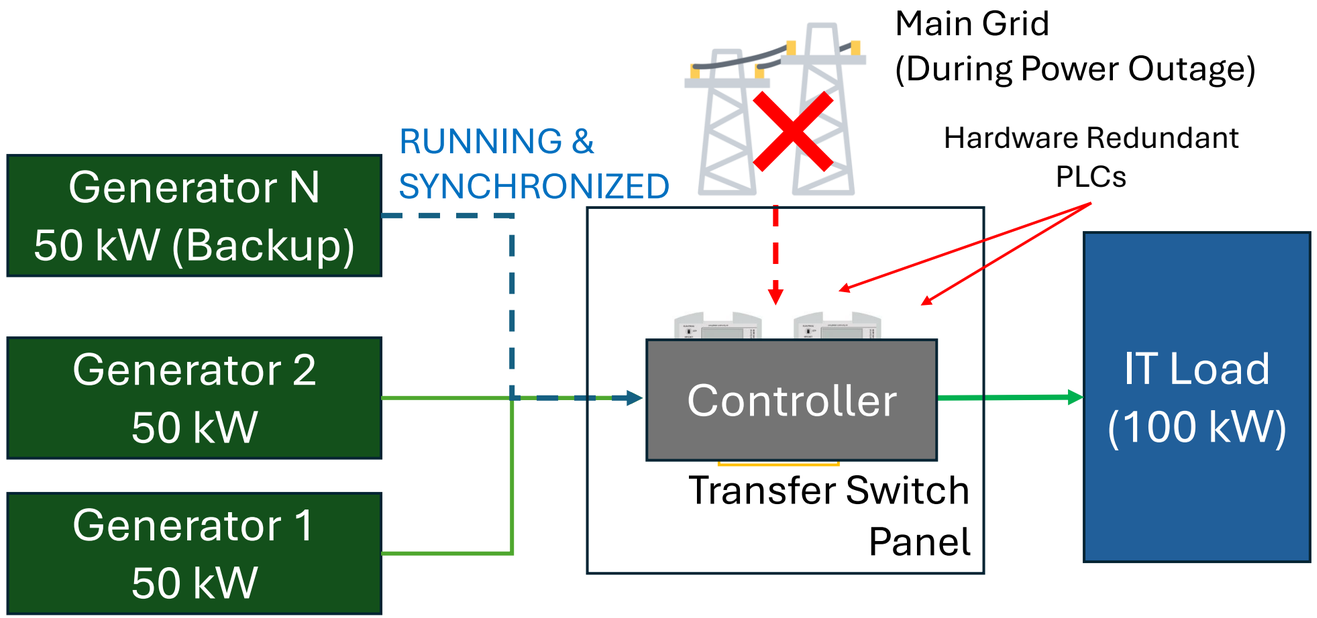


+

- 2N+1: If primary set fails, the secondary set take over and the extra genset to take over any genset failures in any active set

Redundancy Terms in Control System Context

- The controller itself also cannot be a **single point of failure**.
- Using **hardware redundant PLCs** ensures that if the primary controller fails, the **secondary unit takes over** the control without interruption to **maintain control continuity** for the entire power system.



N+1 Hot Standby Architecture

2nd Consideration: Sustainability

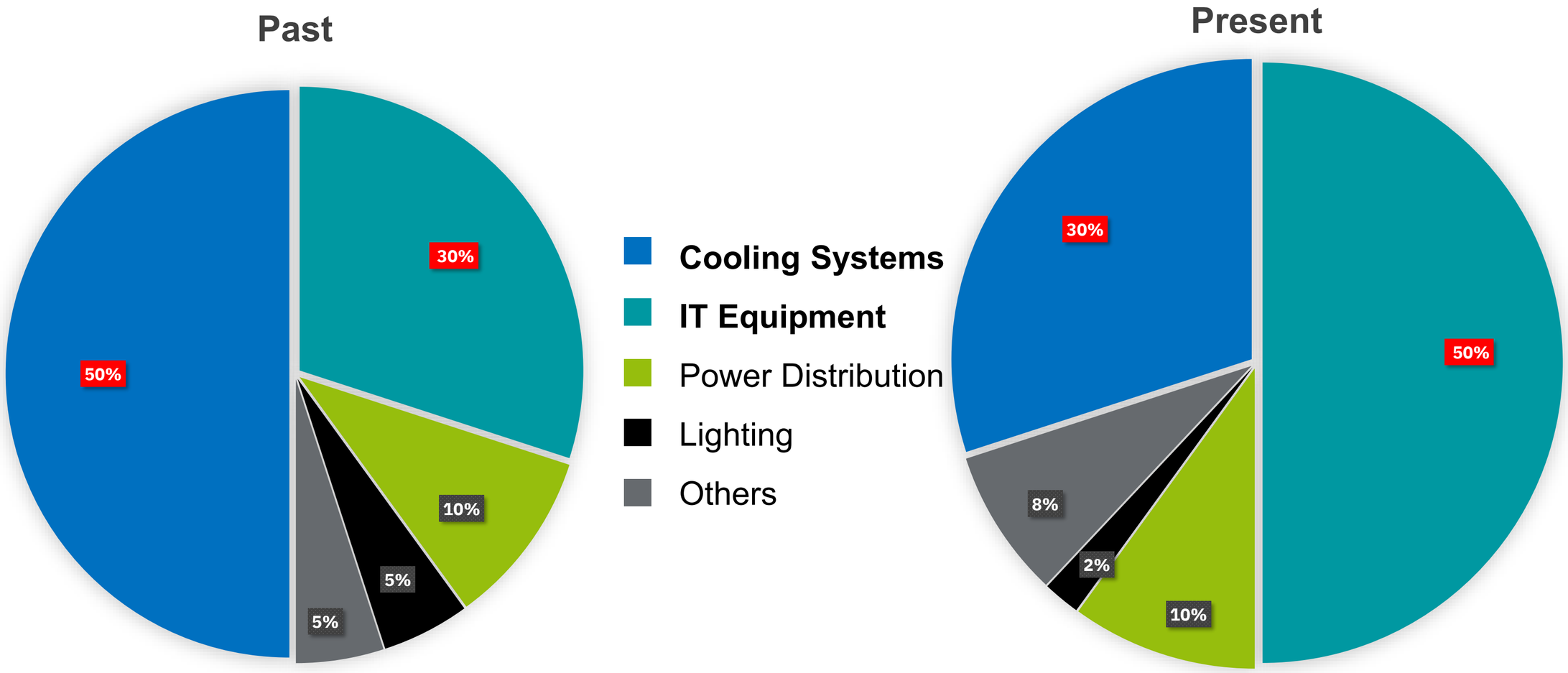
IIEE Seminar

Key Performance Indicators (KPIs) in Sustainability

- Power Usage Effectiveness (PUE)
- Water Usage Effectiveness (WUE)

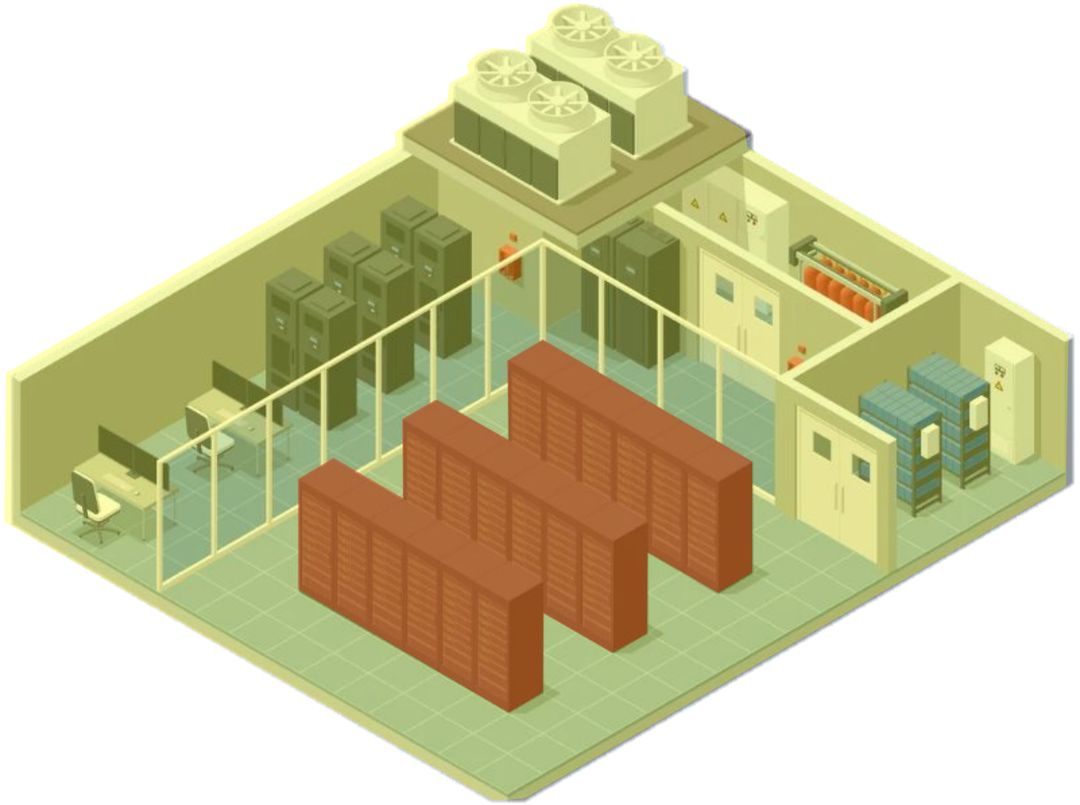
IIEE Seminar

Data Center Power Consumption Breakdown



KPI: Power Usage Effectiveness (PUE)

- Power usage effectiveness (PUE) is a metric used to **determine the energy efficiency** of a data center.
- PUE is expressed as a ratio, where a **lower PUE indicates better energy efficiency** for a data center.



$$PUE = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

**Ideal PUE = 1.0 (Indicates perfect efficiency)*
Average PUE ≈ 1.58

To lower PUE in a data center:

- 1) Optimize Cooling Systems
- 2) Lighting Optimization – Data Hall
- 3) Replace/Upgrade inefficient hardware

KPI: Water Usage Effectiveness (WUE)

- Water usage effectiveness (WUE) is a metric that measures how **efficiently** a data center uses water.
- WUE compares **total water consume by a data center** to the **energy consume by its IT equipment**.

$$\text{WUE} = \frac{\text{Data Center Water Consumption (L)}}{\text{IT Equipment Energy Consumption (kWh)}}$$

**Average WUE = 1.8 L/kWh*
(1.80 liters of water used per kilowatt-hour of electricity consume)

To improve data center WUE:

- 1) Raise indoor temperature and humidity
- 2) Use efficient cooling systems – Liquid Immersion
- 3) Using sustainable water sources – Recycled Water

Future Challenges & Solution

IIEE Seminar

Quiz 2

How much <u>electricity</u> and <u>water</u> does <u>ONE</u> heavy ChatGPT query use?

1% | 10% | 20%

1ml | 250ml | 500ml

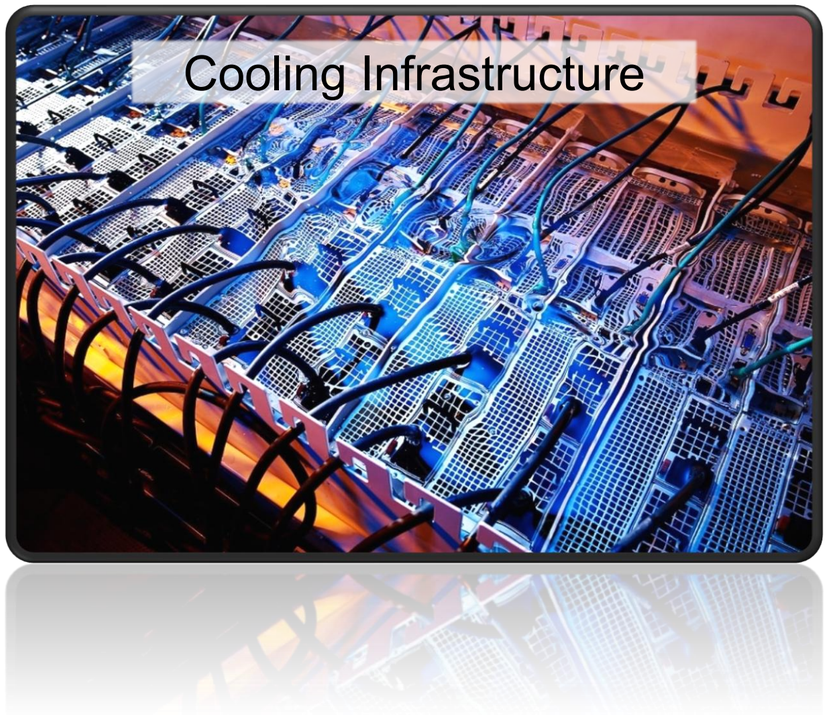
**Phone battery reference*

IIEE Seminar

Challenges Faced Today

Future Data Center Innovations – Overview

To support high-density AI workloads
- AI Racks Density > 100kW – 300kW
- Future Racks > 500kW – 1MW



To remove heat generated by processors
- Air cooling became insufficient
- Liquid cooling advancement

IIEE Seminar

Future Data Center Innovations – DC Microgrids

Power Plants (AC Grids) → DC Microgrids ← PV Panels, Wind Turbines, Battery Storage

DC Microgrid for future Data Centers (AI)

🔋 **Improved Energy Efficiency**
Reduces conversion losses by distributing power in direct current (DC)

🌎 **Supports Renewable Integration**
Easily connects with solar panels, wind turbines, and battery storage

🏭 **Minimizes Infrastructure Complexity**
Simplifies power architecture, eliminates multiple AC-DC conversions

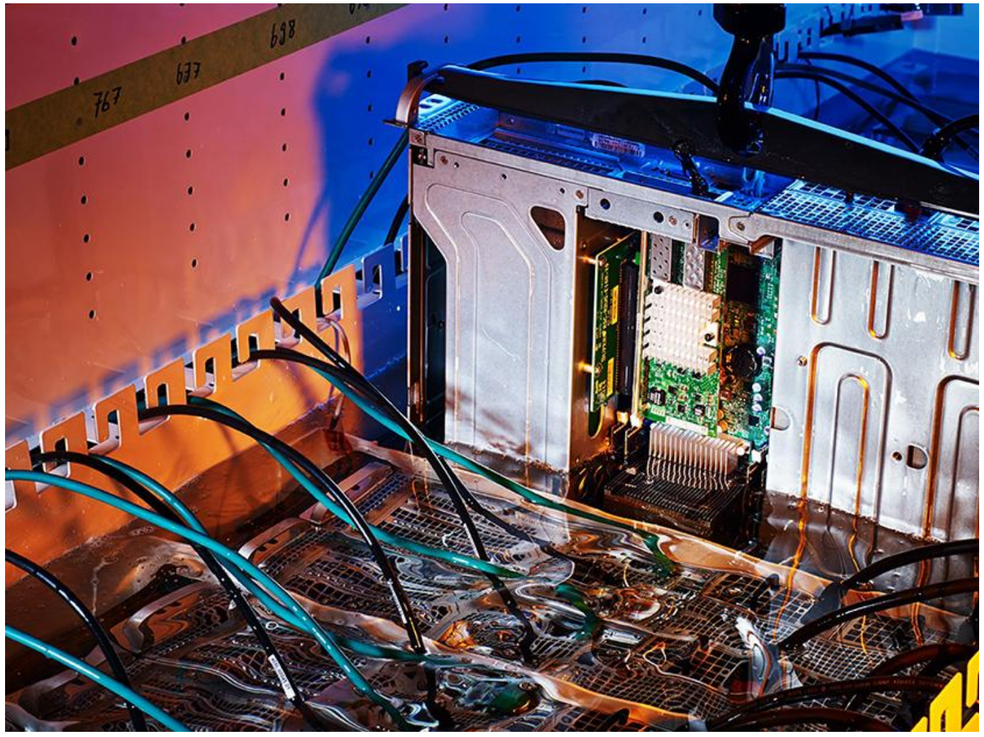
🔌 **Reliable & Resilient Power Supply**
Enhances uptime with localized, self-sustaining energy systems

📉 **Lower Operational Costs**
Reduces energy waste and improves long-term cost efficiency

IIEE Seminar

Future Data Center Innovations – Liquid Immersion Cooling

Air Cooling	Liquid Cooling (Direct-To-Chip)	Immersion Cooling



Immersion Cooling Project

❄️ **Superior Cooling Efficiency**
Delivers unmatched thermal performance

💧 **Submerged Servers**
Fully immersed in a dielectric (non-conductive) liquid

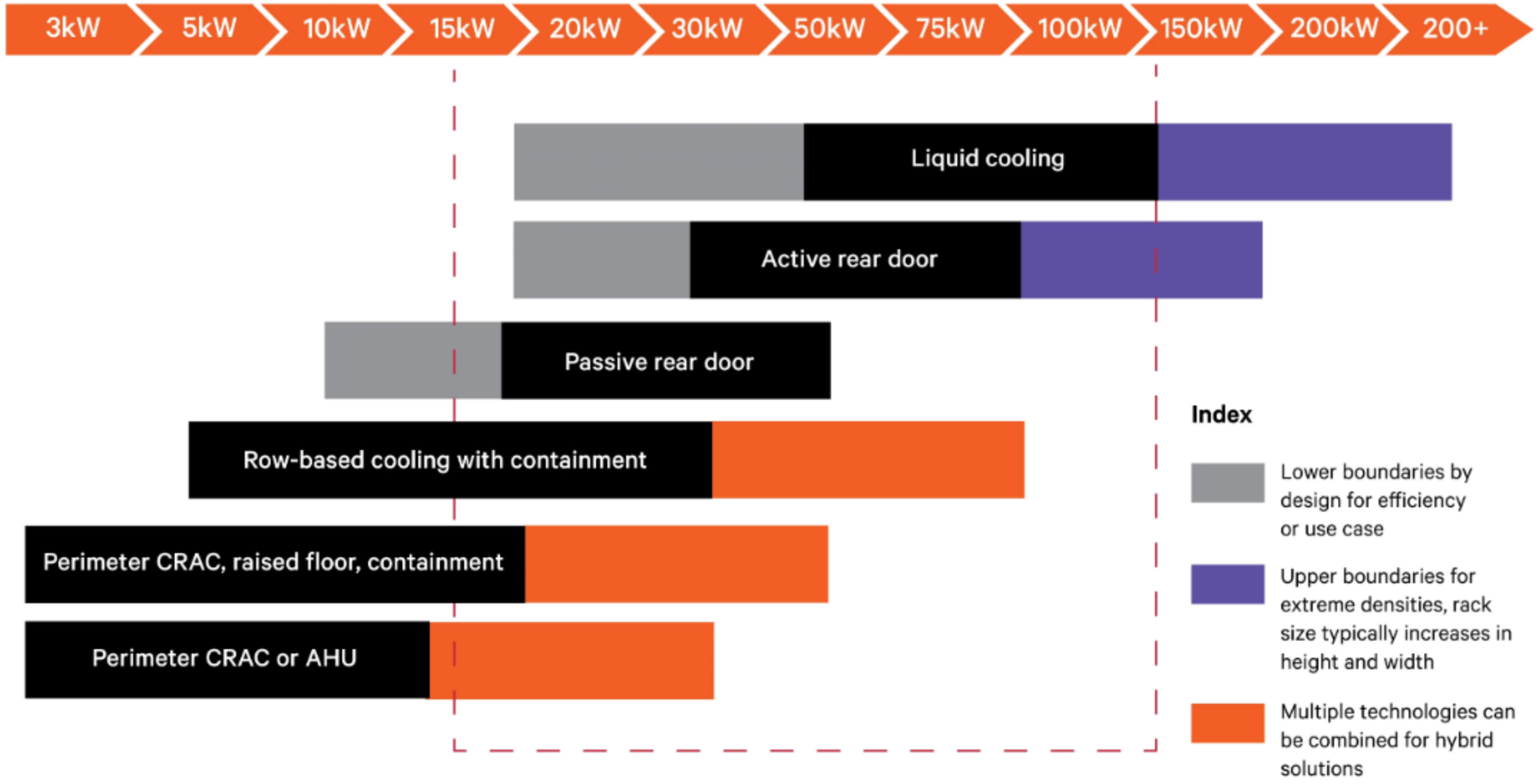
⚙️ **High-Performance Computing (HPC)**
Ideal for HPC environments with dense workloads

🔋 **Energy Efficient**
Minimizes the need for fans and air conditioning

🌱 **Eco-Friendly**
Less energy consumption and lower emissions

IIEE Seminar

Cooling Technology Evolution



Vertiv: *How cooling technology evolves as rack density increases in the data center.*

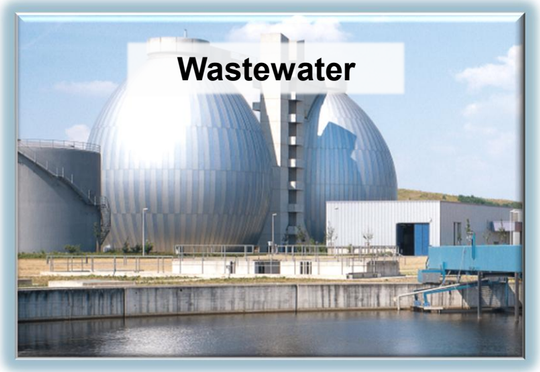
Phoenix Contact

Your Solution Partner

IIEE Seminar

Focus Industry: Data Center

Infrastructure Industry



Global Campaign

Here, availability meets responsibility

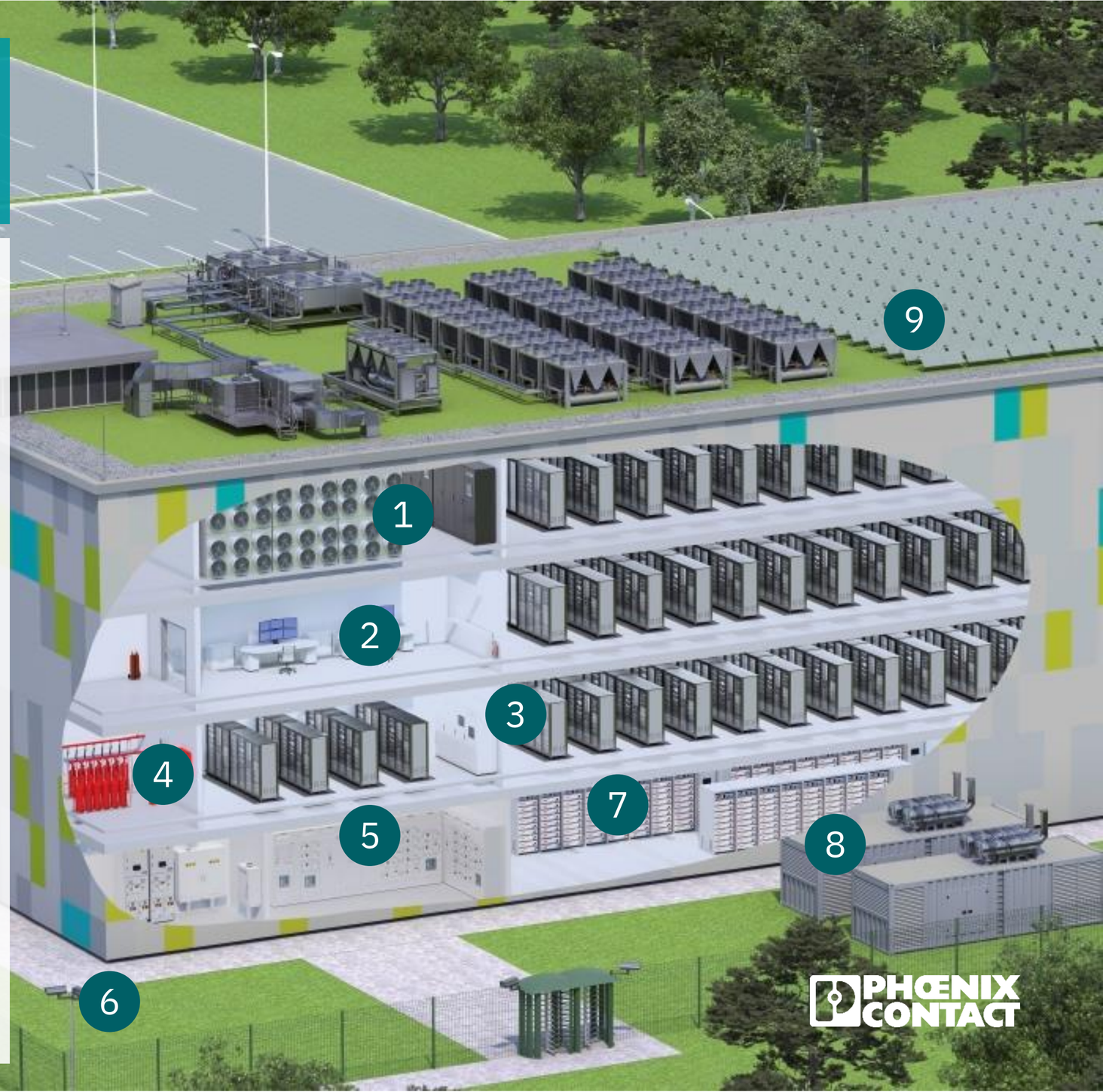
At Phoenix Contact, we provide solutions for data centers where reliability and environmental responsibility go hand in hand. To reduce the carbon footprint, we are committed to the All Electric Society and use energy-efficient technologies and renewable energy sources.

- Power supply and protection systems: ensuring smooth operation and avoiding downtimes
- Connection technology: reliable data transmission and efficient power distribution
- Monitoring and management systems: optimization of operations and reduction of energy consumption
- Target: maintain uninterrupted operation, increase efficiency, and support green initiatives for future-proof data centers

Phoenix Contact‘s Solutions

Subsystems & Focus

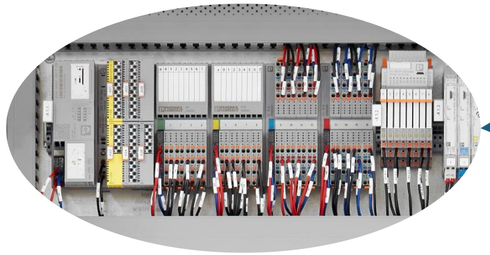
1. Cooling Infrastructure
2. Control Center, BMS
3. Server Room Power Distribution
4. Fire Alarm System
5. Low Voltage Switch Gear
6. Video Surveillance
7. Emergency Power Supply - Batteries
8. Generator & Fuel Monitoring
9. Solar Rooftop System



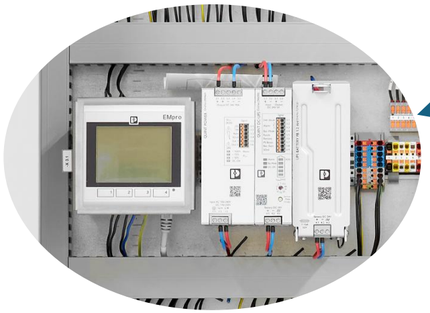
With >85,000 products, together we can shape your solution

Innovative Product Category

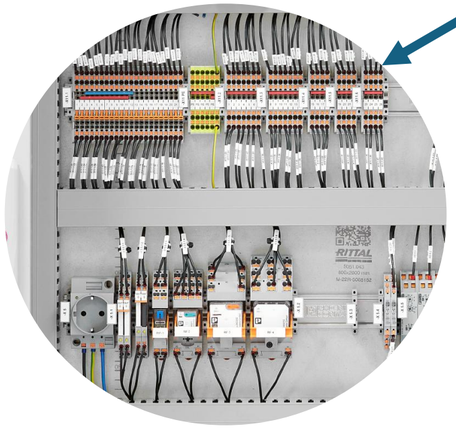
Control
- Industrial PLC
- Niagara Controllers
- PLC Logic
- Remote I/O

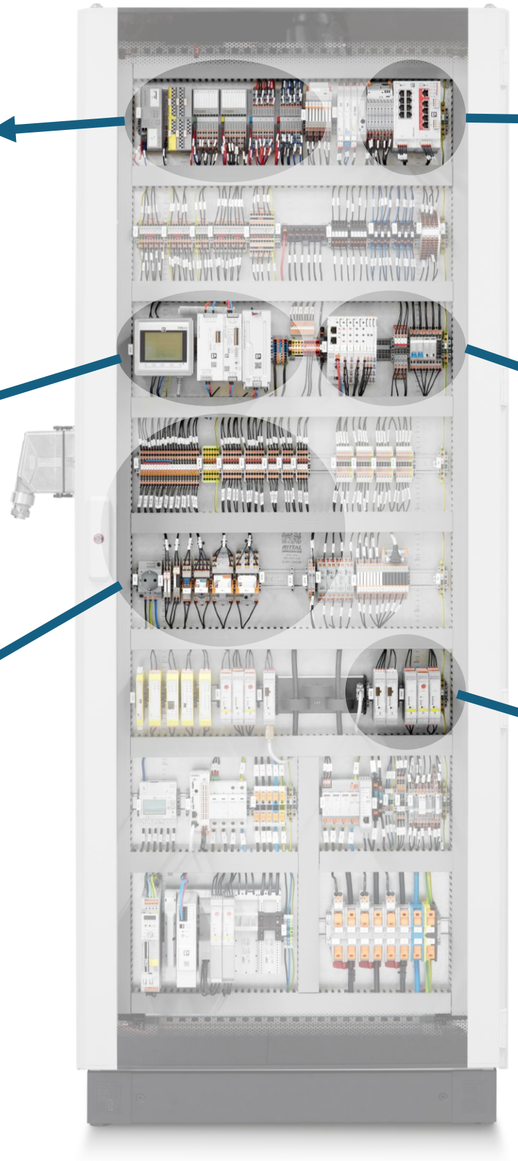


Power
- Power Supply & UPS
- Surge Protection Device
- Monitoring & Metering



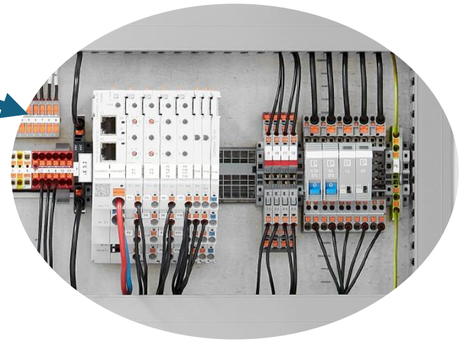
Connectivity
- Terminal Blocks
- Relay Switching
- Heavy-duty connectors





Network
- Managed/Unmanaged Ethernet Switches
- WLAN, Wireless Router
- Gateway (Modbus, etc..)

Protection
- Electronic Circuit Breaker
- Multichannel with IOL
- Modular DC breaker



Switching
- Hybrid Motor Starter
- Solid-state Relays

IIEE Seminar

Phoenix Contact Initiatives

Open Compute Project (OCP)

OPEN Compute Project®

MEMBER

ami, ADATA, AMD, ASE, SPEED, Auras, AXIADO, BellWether, BizLink, BROADCOM, Celestica, CoolIT systems, Danfoss, DELTA, DIGITIMES, eagecare NETWORKS, flex, GIGA COMPUTING, Google, insyde, ITRI, KEYSIGHT, LOTES, Meta, msi, muRata INNOVATOR IN ELECTRONICS, nuvoTon, PEGATRON, RITTAL, SANBlaze, SEAGATE, STULZ, Submer, SUPERMICRO, TE, PHOENIX CONTACT, SENSEK, Y.S.TECH

Collaborative community – Launched by **Meta** in 2011

- Rethink and **redesign hardware** technology
  - Efficiently support growing demands of Data Center

To create **open-source** hardware designs to:

1) Improve Performance of Data Centers
2) Reduce Costs (up to 24% less costly to operate)
3) Enhance Energy Efficiency (up to 40%)

Collaboration on Specifications:

- **Racks:** Open Rack V3 (ORV3)
- **Servers:** DC-MHS (Data Center Modular Hardware System)

IIEE Seminar

Phoenix Contact Initiatives

Open Direct Current Alliance (ODCA)

ODCA
direct current by zvei

Founded in 2022 by:

ZVEI (German Electro and Digital Industry Association)

To adopt **direct current (DC) technology**

- Support resource-saving
- CO_2-neutral energy future

Why it matters:

- ✓ 33% less conductor material
- ✓ 75% reduction in power loss
- ✓ Simplified installation & maintenance
- ✓ Streamlined integration of renewables & storage

Product Portfolio for Data Center Applications

Power Supplies

Redundancy Module

Electronic Circuit Breaker

Surge Protection Device

Energy Meter

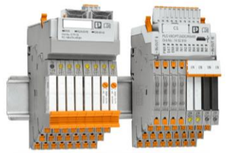
Industrial Controller

BMS Controller

Ethernet Switch

Gateway

Smart Relay



IIEE Seminar

Contact Us

Let‘s Connect

Chayangkul Sumitpaibul
Business Development Engineer

Office: 80 Bendemeer Rd,
#09-01A/#10-02, Singapore 339949

Phone: +65 9652 2929
Mail: csumitpaibul@phoenixcontact.com.sg

LinkedIn: https://www.linkedin.com/in/chayangkul

Thank you

Chayangkul Sumitpaibul (Aang)
Business Development Engineer, Infrastructure
csumitpaibul@phoenixcontact.com.sg
+65 9652 2929

PHOENIX CONTACT SOUTHEAST ASIA

INSTITUTE OF INTEGRATED ELECTRICAL ENGINEERS 1975

SINGAPORE CHAPTER 2011

ENGINEERING *RESILIENCE*

Enabling Industries through Innovation